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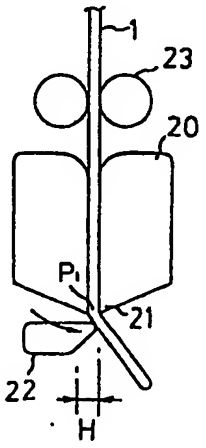
(54) **METHOD OF BENDING BAND KNIFE.**

(57) This invention discloses a method of bending a band knife, comprising the step of forming a bent portion of a predetermined angle on a band knife (1), which is sent out intermittently from an outlet of a mold (20), by using a push member (22) which can be moved a predetermined width, and a molding surface (21) provided at the outlet of the mold (20), while the feeding of the band knife (1) is stopped, whereby a desired arcuate shape can be easily obtained.

Fig.1B



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TITLE MODIFIED
see front page

Specification

Band Blade Bending Method

Technical Field

The present invention relates to a method of bending a band blade used for a so-called Thomson blade wooden model or the like, such that the band blade has curved portions each having the desired radius of curvature.

Background Art

A Thomson blade wooden model is used for punching, into a predetermined shape, a plate-like material such as wood, paper, cloth, leather, plastics, etc., or for forming a slit unit of a predetermined shape in such plate-like material. As understood from Fig. 3, such a wooden model may be made by pushing and embedding band blades 1 each bent into a predetermined shape, to and in a base member 2 in a slit unit 3 formed therein. In the wooden model as completed, the tips 4 of the band blades 1 project from the base member 2.

The Thomson blade wooden model shown in Fig. 3 is used for forming a slit unit of a predetermined shape, in the plate-like material above-mentioned. In this

connection, a plurality of band blades 1 are used with small-width gaps 5 provided therebetween. The slit unit 3 includes a plurality of slits which are intermittently formed and generally form contours identical in shape with those of the band blades 1. Non-slit portions 6 in which slits are not formed, are opposite to the gaps 5 and concaves 7 of the band blades 1. Pressing blades 8 for forming folding lines may be embedded in the base member 2, as necessary.

When making such a Thomson blade wooden model, it is required that the general contours of the slit unit 3 be identical or substantially identical in shape with those of the band blades 1. If the difference in shape therebetween is excessively great, the band blades 1 cannot be embedded in the slit unit 3. In this connection, if the band blades 1 are required to have arcuate portions, the radiuses of curvature of these arcuate portions need to be identical or substantially identical with those of the curved portions of the slit unit 3.

Conventionally, such curved portions are formed by bending the band blades 1 as outlined below.

Each band blade 1 in a state before bent, is placed on a grooved concave 11 in a lower mold 10 as shown by virtual lines in Fig. 4. Then, the band blade 1 is beaten with an upper mold 12, causing the blade 1 to be

bent into the concave 11, while the beating force is adjusted according to the actual bending state. These forming operations are carried out for a plurality of portions in a predetermined width of of the band blade 1.

In such a method, it is difficult to properly adjust the force applied for beating the band blade, causing the same to be bent. Further, the band blade presents springback. Accordingly, advance ability and skill are required to accurately form such curved portions having the desired radiuses of curvature. That is, such bending cannot be easily made by anybody.

The present invention is proposed to solve the problems above-mentioned with the object of providing a method of bending a band blade into a predetermined shape readily and promptly even by beginners without special training.

Disclosure of the Invention

To achieve the object above-mentioned, the band blade bending method of the present invention comprises the steps of:

intermittently feeding a band blade from the outlet of a mold; and

moving, at periods of time that such feeding is

halted, pushing means by a predetermined distance such that the band blade is pushed to a forming portion of the mold at the outlet thereof, causing the band blade to be bent at a predetermined angle.

According to the present method, by intermittently feeding a band blade from the outlet of the mold, a plurality of portions of the band blade spaced from one another at regular intervals are successively brought to a position opposite to the forming portion of the mold at the outlet thereof. While such feed is halted, the pushing means is moved by a predetermined distance such that the band blade is pushed to the forming portion, causing the band blade to be bent at a predetermined angle. All bending angles of the portions thus bent are the same. Accordingly, the band blade may have an arcuate portion having the desired radius of curvature, by properly setting the bending angle of the band blade and the number of bending times. For example, when the intermittent feed distance of the band blade is set to a predetermined value, the arcuate portion having the desired radius of curvature may be accurately formed by merely controlling the bending angle.

According to the band blade bending method of the present invention, the band blade may be bent readily and accurately so as to have arcuate portions each

having the desired curvature of radius. Further, such bending may be readily achieved by not only those skilled but also by beginners without special training. Further, the bending may be carried out as controlled by a computer. This enables to carry out a complicated bending which would otherwise be carried out with an extreme difficulty in a conventional technique.

Brief Description of the Drawings

Figure 1A to Figure 1D are views illustrating the steps of a bending method in accordance with the present invention;

Figure 2 is a side view of an arcuate portion of a band blade bent according to the steps shown in Figure 1A to Figure 1D;

Figure 3 is an exploded perspective view of a Thomson blade wooden model; and

Figure 4 is a view illustrating a conventional bending method.

Best Mode For Carrying Out the Invention

Fig. 1A to Fig. 1D show steps of a bending method in accordance with the present invention.

In Fig. 1, a mold 20 is provided at the outlet corner thereof with an acutely pointed forming portion

21. Pushing means 22 is movable toward and away from the forming portion 21 along an arcuate passage A-A shown in Fig. 1A. Feed rollers 23 are disposed for intermittently feeding a band blade 1.

As shown in Fig. 1A, the feed rollers 23 are first rotated by a predetermined angle such that the band blade 1 is sent out from the outlet of the mold 20. Here, the predetermined angle of rotation of the feed rollers 23 is determined such that feeding the band blade 1 is halted when a predetermined portion P_1 of the band blade 1 is brought to a position opposite to the forming portion 21.

Then, the pushing means 22 is moved right by a predetermined amount along the arcuate passage A-A, as shown in Fig. 1B. This causes the band blade 1 to be pushed to the forming portion 21 such that the portion P_1 is bent at a predetermined angle.

The pushing means 22 is then returned to the original position as shown in Fig. 1C. The feed rollers 23 are again rotated by a predetermined angle to feed the band blade 1. Such feed is halted when a portion P_2 of the band blade 1 is brought to a position opposite to the forming portion 21, the portion P_2 being apart from the portion P_1 already bent, by a predetermined distance.

As shown in Fig. 1D, the pushing means 22 is moved right by the predetermined distance. The band blade 1 is pushed to the forming portion 21, causing the band blade 1 to be bent at the predetermined angle.

By repeating the steps above-mentioned, the band blade 1 is bent at a plurality of portions thereof at regular spatial intervals. This causes the band blade 1 to be bent generally in the form of a circular arc.

According to the method above-mentioned, when the moving distance H of the pushing means 22 is set to a predetermined value, all bending angles of the band blade at a plurality portions thereof (P_1, P_2 ..) are the same. Further, when the intermittent feed distance D of the band blade 1 intermittently fed by the feed rollers 23 is set to a predetermined value, all distances between the portions (P_1, P_2 ..) to be bent are the same.

For bending the band blade 1 into an arcuate shape, the intermittent feed distance D of the band blade 1 may be determined such that, for example, equally divided portions to be bent of the band blade 1 are successively brought to a position opposite to the forming portion 21. Further, the number of bending times is calculated with the use of (i) the bending angle of the band blade 1 bent by one pushing operation of the pushing means 22

thereto and (ii) the radius of curvature of the arcuate portion desired to be formed by bending. By properly setting these values, an accurate bending may be achieved.

It is required to take springback of the band blade 1 into consideration when setting the bending angle of the band blade 1 bent by one pushing operation of the pushing means 22 thereto. More specifically, the bending angle of the band blade 1 bent by the pushing means 22 is should be set to an angle in which the desired bending angle of the band blade 1 is added to the angle to be restored by the springback.

When bending the band blade 1 at a right angle, it is required to increase the moving distance H of the pushing means 22. In such bending at a right angle, it is useful that the forming portion 21 is acutely pointed and the pushing means 22 is movable along the arcuate passage A-A.

More specifically, when the band blade 1 is bent, the band blade 1 is slightly restored due to springback after such bending. Accordingly, provision is made such that the pushing means 22 is moved slightly upward along the arcuate passage A-A after having passed under the forming portion 21. This causes the band blade 1 to be bent at an acute angle smaller than a right angle. After

the pushing means 22 has been retreated, the band blade 1 is restored to a right angle by the springback.

Fig. 2 shows an arcuate portion of the band blade 1 bent according to the steps shown in Fig. 1A to Fig. 1D.

In Fig. 2, A shows an opening angle between both ends of the arcuate portion formed by bending, while a shows opening angles between the portions bent by the pushing means 22. Here, the opening angles a are equal to one another; that is, each of the opening angles a is an angle obtained by equally dividing the opening angle A. r is a radius of curvature of the arcuate portion.

Industrial Applicability

According to the band blade bending method of the present invention, the bending operation may be controlled by a computer, by previously entering therein a pattern of feed amounts of a band blade fed from the mold outlet and a predetermined moving amount of the pushing means. Thus, the present method may be used for bending a material into a relatively complicated shape.

Claims:

1. A band blade bending method comprising the steps of:

intermittently feeding a band blade from the outlet of a mold; and

moving, at periods of time that said feeding is halted, pushing means by a predetermined distance such that the band blade is pushed to a forming portion of said mold at said outlet, causing the band blade to be bent at a predetermined angle.

2. A band blade bending method as set forth in Claim 1, wherein the moving amount of the pushing means is determined such that the band blade is bent at a predetermined angle in which the desired bending angle of the band blade is added to the restoring angle of the band blade due to springback thereof.

3. A band blade bending method as set forth in Claim 1, using a mold provided at the corner of the outlet thereof with an acutely pointed forming portion.

4. A band blade bending method as set forth in Claim 1, wherein the pushing means is moved by a pre-

determined distance along an arcuate passage.

5. A band blade bending method as set forth in Claim 1, to be controlled by a computer in which previously entered are data including (i) feeding amounts of the band blade fed from the mold outlet and (ii) a predetermined moving distance of the pushing means.

6. A band blade bending method as set forth in Claim 2, using a mold provided at the corner of the outlet thereof with an acutely pointed forming portion.

7. A band blade bending method as set forth in Claim 6, wherein the pushing means is moved by a predetermined distance along an arcuate passage.

8. A band blade bending method as set forth in Claim 7, to be controlled by a computer in which previously entered are data including (i) feeding amounts of the band blade fed from the mold outlet and (ii) a predetermined moving distance of the pushing means.

Fig.1A

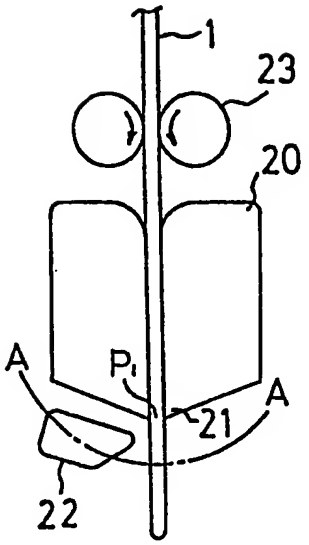


Fig.1B

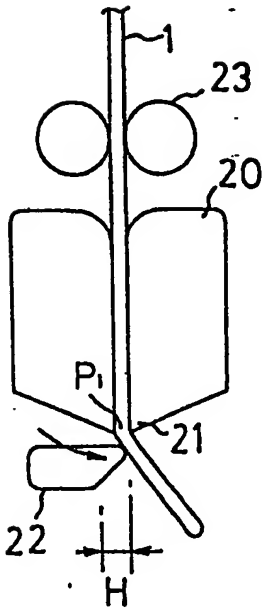


Fig.1C

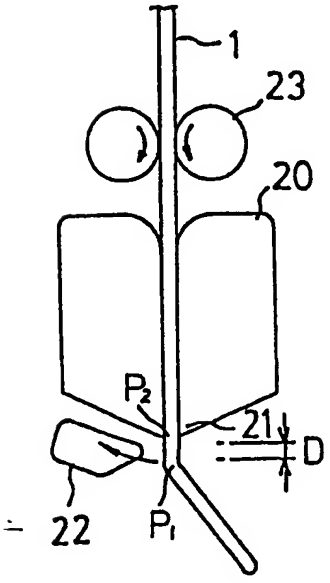


Fig.1D

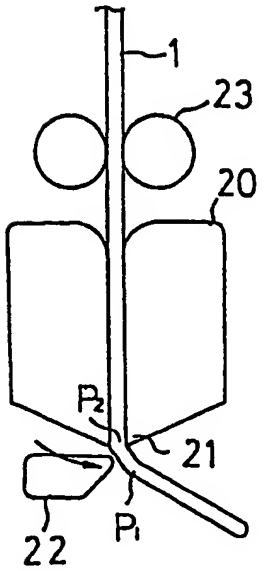


Fig.2

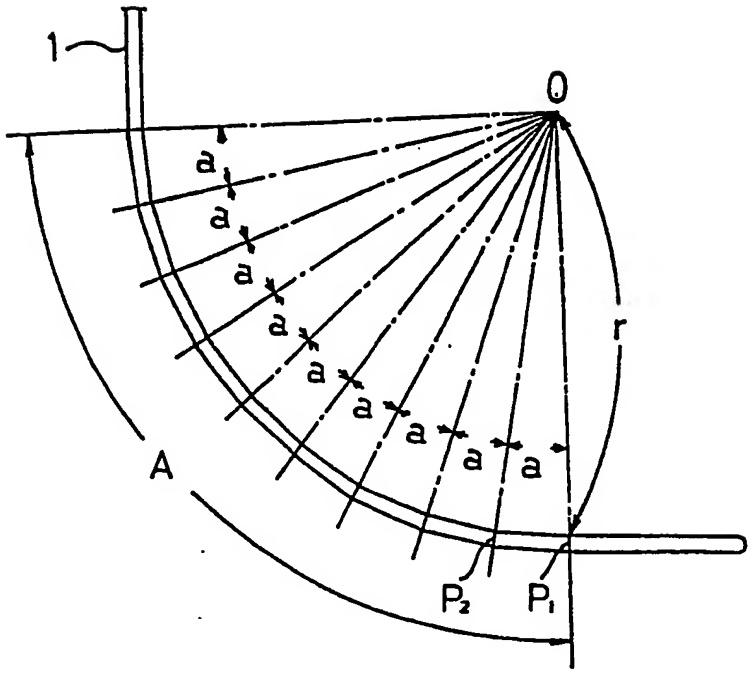


Fig.3

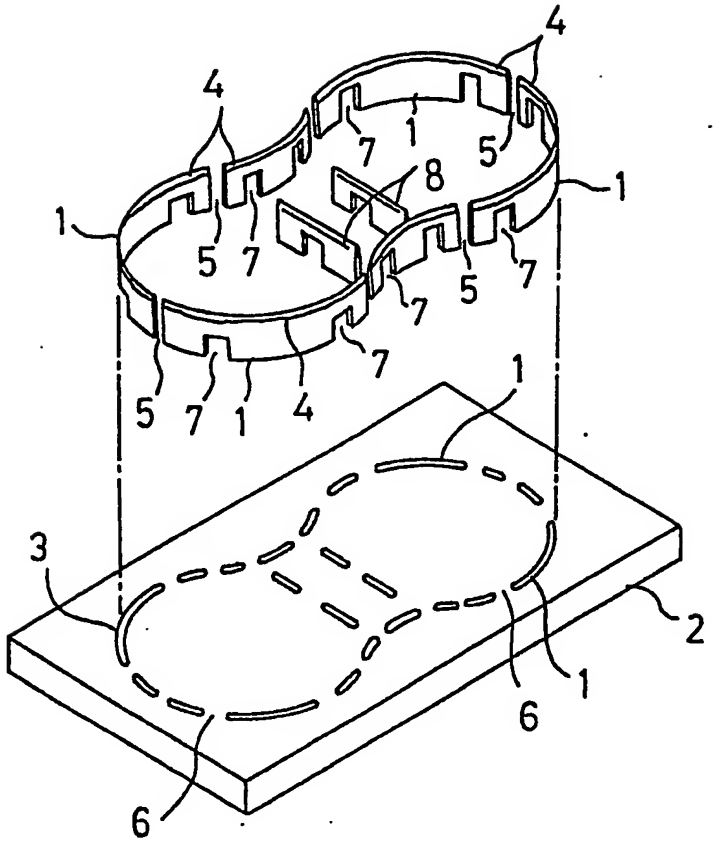
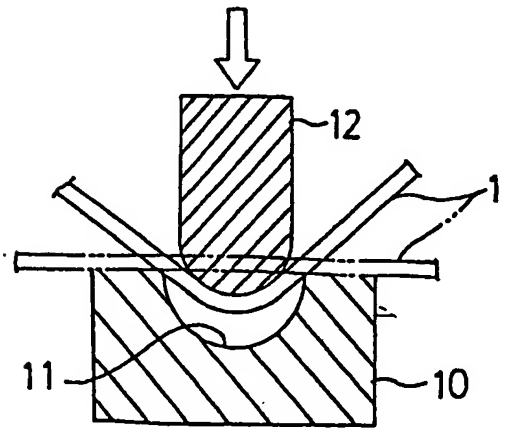


Fig.4



INTERNATIONAL SEARCH REPORT

International Application No PCT/JP88/00472

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl[4] B21D5/01

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	B21D5/00-5/01

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

Jitsuyo Shinan Koho 1926 - 1988
Kokai Jitsuyo Shinan Koho 1971 - 1988

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	JP, Y1, 39-10341 (Hitachi, Ltd.) 21 April 1964 (21. 04. 64) (Family: none)	1-8

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
July 27, 1988 (27. 07. 88)	August 8, 1988 (08. 08. 88)
International Searching Authority	**Signature of Authorized Officer**
Japanese Patent Office	